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Year 2000 Plan for the ECS Project

White Paper

White Paper--Not intended for formal review or
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RESPONSIBLE ENGINEER

Mac McDonald /s/ 10/8/97

Mac McDonald, System Engineer Date
EOSDIS Core System Project

SUBMITTED BY

Paul Palmer /s/ 10/8/97

Paul Palmer, System Engineering Manager Date
EOSDIS Core System Project

Hughes Information Technology Systems
Upper Marlboro, Maryland

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Abstract

This white paper presents the plan for ensuring that the ECS system is year 2000 compliant. It addresses issues related to Y2K compliance and ECS requirements, design, and test activities intended to support this goal.

Keywords: Y2K, Year 2000, requirements, IRD, RbR, Level 4, CSS Time Service, DCE Time Service, Rogue Wave, COTS

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Abbreviations and Acronyms

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1. Introduction

1.1 Purpose

This white paper is a plan by which Year 2000 (Y2K) ECS system analysis and upgrades are to be accomplished, including the early development of Y2K Level 4 requirements. ECS Technical Direction Number 28, Year 2000 Requirements, directed ECS to develop and document this plan.

1.2 Organization

This paper is organized as follows:

Section 2.1 contains general discussion regarding Y2K issues and describes ECS activities to address them. Section 2.2 summarizes a timeline for these activities.

1.3 Review and Approval

This White Paper is an informal document approved at the Office Manager level. It does not require formal Government review or approval; however, it is submitted with the intent that review and comments will be forthcoming. Questions regarding technical information contained within this Paper should be addressed to the following ECS and/or GSFC contacts:

- ECS Contacts
 - Mac McDonald, System Engineer, (301)925-0364, mac@eos.hitc.com

Questions concerning distribution or control of this document should be addressed to:

Data Management Office
The ECS Project Office
Hughes Information Technology Systems
1616 McCormick Drive
Upper Marlboro, Maryland 20774-5372

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2. Y2K Plan

2.1 Y2K Problem

The Year 2000 (Y2K) problem stems from the programming practice of attempting to conserve computer resources (e.g., memory, disk space, screen area) by storing and processing year dates as non-absolute two digit fields. Although this worked as long as all years in question began with the same two digits (“19xx”), as of the year 2000 it can become ambiguous which two digits will/should precede “xx” to form the desired four digit year - “19” to form “19xx” or “20” to form “20xx”. Along with the obvious potential problem of dates mistakenly being interpreted as 100 years earlier than they should be, date comparisons between 19xx and 20xx may be in error when based only on the final two digits.

Although not directly related to the situation described above, another significant event that coincidentally arises in the year 2000 is the exercise of a relatively seldom used part of the rule for identifying leap years. The rules for determining whether a given year is a leap year are:

1. If the year is evenly divisible by 4 it is a leap year, except for years ending in 00.
2. A year ending in 00 is a leap year if it is evenly divisible by 400.

The first part of the rule given above is the commonly understood definition of a leap year. But the much less frequently used second part of the rule is less commonly understood. This rule produces the result that although 1900 and 2100 are not leap years, 2000 is a leap year.

2.1.1 Requirements

ECS Level 4 requirements addressing various date issues which includes Y2K (New Century and Leap Year) have been defined and baselined in the requirements database (RTM). Each SCDO software CI/service and FOS have a requirement of the following form, where xxxx is the component:

The xxxx shall ensure that the following calendar transitions are handled completely and accurately:

- a. New Year
- b. New Decade
- c. New Century
- d. Leap Year.

Further analysis will be performed to determine whether other more specific requirements are necessary. Areas for special consideration are GUI inputs, software COTS interfaces, data migration, and external interfaces.

No COTS hardware specific Y2K requirements have been or are expected to be included just as no COTS software specific Y2K requirements were included. Both COTS hardware and software will be evaluated for procurement based on their ability to support the software CIs/services for which they are allocated. And they will be tested as part of the component they support. Thus these COTS products, including the operating systems of hardware platforms, will be tested for support of these requirements.

ECS Technical Direction Number 28, Year 2000 Requirements, states that “ECS shall include the Y2K requirements in all external interfaces, as appropriate.” Under the assumption that ECS External Interfaces are already thought to be Y2K compliant and after considering the resources that would be required to coordinate and update each of approximately 30 ECS IRD documents, the ECS Chief Engineer (Joe Guzek) and the ECS COTR (Curt Schroeder) verbally agreed that instead of generating external interface requirements an audit of these interfaces was more appropriate at this time. Therefore, ECS will conduct an audit of its external interfaces to verify Y2K compliance. This audit will begin with IRD and ICD review, and may result in further investigative discussions with the representative external organization if that review reveals any potential problems or proves inconclusive. A Technical Paper will be generated to document the results of the audit.

2.1.2 Design

The ECS Communications Subsystem (CSS) Time Service provides a common set of time access services. These services provide centralized control for time retrieval, comparison, and calculation methods in support of all ECS custom software. No ECS custom software will use any other time methods, except for the Rogue Wave Time widget which handles date/time entry. This directive is enforced during design and code review activities.

All ECS designed user GUIs require year parameters to be submitted for processing as four digits. Web based user and operator GUIs require year information to be entered by users as four digits. X/Motif GUIs require either four digit years to be entered or, if using the Rogue Wave object RWTime, allow two digits to be entered with Rogue Wave automatically adding the prefix “19”. Although it is unclear when the Rogue Wave libraries will be updated to add the prefix “20” for user interoperability in the next century, whatever prefix Rogue Wave adds to the year is apparent to the user on the screen before the parameter is submitted for processing. If it is incorrect, the user can enter the full four digit year.

All ECS external interface dates used for time reference are currently defined to include four digit years which will avoid any Y2K rollover confusion. There are a limited number of instances where two digit years are embedded in file names, but no time calculations are performed by ECS based upon these filenames. This is documented in the ICDs and will continue to be the standard for future ICDs. As mentioned earlier, an audit will be performed to verify these assertions.

2.1.3 COTS

ECS is heavily dependent on the integration of COTS, both hardware and software. COTS are evaluated for procurement with Y2K compatibility as a major criteria. ECS further obtains written assurances from vendors that their products are or will be Y2K compliant.

The three Unix vendors (Sun, HP, SGI) that are currently part of the ECS baseline architecture will have operating systems or patches available for Y2K compliance. HP has had updates available for HP-UX 10.01, 10.10, and 10.20 since February 1997. A Y2K compliant upgrade for Sun Solaris 2.5.1 will be available in September 1997. SunOS 5.5 (also in the Rel B baseline configuration) is not currently scheduled for compliance, so it may need to be phased out of the baseline before the year 2000. SGI's IRIX 6.5, scheduled for release in mid 1998, will be Y2K compliant. SGI is committed to making IRIX 5.3, 6.2, and 6.3 Y2K compliant as well. Patches for these versions of IRIX will be available by April 1998. The current Rel B baseline is IRIX 6.2. So the upgrade path for Y2K compliance for these hardware platforms is clear. However, the schedule for these upgrades within ECS is dependent on the replanning activities being performed at this time.

Most modern COTS appear to have adopted 4 digit year formats, thus avoiding typical Y2K rollover problems. But if any are identified as non-Y2K compliant, a clear upgrade path to a Y2K compliant version of that COTS or a different Y2K compliant COTS will be identified. This upgrade must occur at or before the last ECS release before the year 2000.

Many COTS actually only currently support date/times through the year 2037. This is typically a hardware limitation stemming from the use of 32 bit words. This problem will resolve itself as computing platforms migrate to 64 bit word hardware architectures over the next few years.

2.1.4 Test

The major effort involved in Y2K compliance is expected to be testing. After all of the requirements analysis, design and code reviews, and vendor reassurances are accomplished, it still remains to verify that the ECS system is Y2K compliant by actually testing the entire ECS system with simulated dates and times. These simulated time frames will cover at least three general simulation cases:

1. Operations during 1999 which:
 - prepare projections of activities that will occur in 2000 (production plans, resource schedules, etc.)
 - rollover operationally at midnight of Dec. 31, 1999 and go into 2000 (data ingest, production, distribution, activity logs, etc.)
2. Operations which test the leap year condition of 2000 by beginning before:
 - midnight of Feb. 28, 2000 and going into Feb. 29, 2000
 - midnight of Feb. 29, 2000 and going into March 2000

3. Operations during 2001 or some non 2000 year in the 21st century to include pre-year 2000 date use (e.g., search and order for 1999 data)

Although the use of the DCE Time Service to synchronize the time on all platforms used throughout ECS would seem to make this service the obvious place to adjust time for simulation, this may present some problems. It may be difficult to change the time because the DCE Time Service is designed to ignore apparently erroneous time inputs through cross checking of sources. Also changing time references this way results in Unix system clock changes which may lead to undesirable effects when time is returned to the here and now (e.g., timestamps on or in system files). These problems will be investigated with the understanding that there are other options. CSS provides a time service, built on the DCE Time Service, that all ECS custom applications use. Mode management is intended to allow MSS to coordinate with CSS to associate a selected pseudo-time (as an offset from the DCE Time Service real time) for applications executing in a specified mode. But this approach may not conclusively test all COTS software packages.

Testing will include test cases for the following:

1. Both metadata and data generated in 2000 are properly timetagged
2. Messages and any other data items generated in 2000 are properly timetagged
3. Production and resource plans that span midnight of Dec. 31, 1999 have properly timetagged the events in the plan
4. Queries performed in 2000 obtain the correct results when the query parameters span 1999 and 2000
5. Subscriptions submitted in and/or beginning in 1999 still apply and are satisfied in 2000
6. Production Requests and their corresponding PGE information which are entered in 1999 will continue to generate Data Processing Requests without requiring changes in this information in 2000

Assuming that the method of simulating the time frames in question is done by resetting the Unix system clocks, end-to-end testing is expected to verify Y2K compliance of the majority of COTS products integrated in ECS. If testing does not reset the Unix system clocks, then all COTS will need to be tested individually. For those ECS deployed COTS products which will not be verified by end-to-end testing regardless of how time is simulated (e.g., ClearCase, DDTS, etc.), separate individual tests will be performed. Ideally these tests would be performed on separate hardware where the time change would not impact any other systems.

2.1.5 Data Migration

ECS will insure that Data Migration efforts result in ECS metadata and non-native format data that is Y2K compliant. But Y2K compliance of data migrated in its native format remains the responsibility of the data source. ECS will not change native data migrated into the ECS archive. This was stated in the clarification included in the acknowledgment by Hughes of ECS Technical Direction No. 28:

“... Hughes can not ensure that data that is part of the V0 Data Migration effort is interoperatable if a DAAC directs us to store it in its native format. Some native V0 data (HDF and other formats) have embedded 2 digit times in their data fields. It is a DAAC decision as to whether the native time data should be changed to 4 digit times. If the data are changed, the DAAC would have to update any read software. This would result in impact to V0 data migration (alter and validate data) and impact to the DAAC (modify any software that reads the native data). Packed binary files and other data structures may not have room to add 2 more digits. Additionally, anytime we change the internal data or file structures, we would have to apply full validation to make sure we have preserved the integrity of the data.”

2.2 Y2K Plan Summary

The activities in support of ECS Y2K compliance are identified in the table below. Their projected timelines for completion are included.

Table 2-1. Y2K Plan Summary

Activity	Timeline	Description
L4 Requirements Analysis	Initial set of L4s already defined; define any additional L4s as post 2.0 (TBD)	Determine whether new L4 rqmts are required
External Interface Analysis	end of January 1998	Audit each external interface for Y2K compliance
Design	Design and code reviews	Y2K checkoff item in reviews
COTS Procurement	Each COTS procurement	Y2K COTS procurement criteria
Test	As part of post 2.0 test activities (TBD)	Establish test cases to simulate year 2000 rollover and operations
Data Migration	As each data set is migrated	Extracting Metadata compliant with Y2K for the migrated data

Several of the timeline references in the table refer to post 2.0 (TBD). The TBDs in this timeline will be defined when the post 2.0 milestones become identified.

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Abbreviations and Acronyms

CI	Configuration Item
COTS	Commercial Off-the-Shelf
CSS	(ECS) Communications Subsystem
DAAC	Distributed Active Archive Center
ICD	Interface Control Document
ECS	EOSDIS Core System
FOS	Flight Operations Segment
GUI	Graphical User Interface
HDF	Hierarchical Data Format
IRD	Interface Requirements Document
L4	Level 4 (requirements)
RbR	(Level 3) Requirements by Release
RTM	Requirements and Traceability Management
SCDO	Science and Communications Development Office
V0	Version 0
Y2K	Year 2000

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